

**CHAPTER 2**

**SOILS**

**(R645-301-200)**

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### CHAPTER 2: SOILS

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## CHAPTER 2

### SOILS (R645-301-200)

#### 2.10 Introduction:

This chapter presents soil resource data and soil mapping for the Crandall Canyon Mine. This information has been compiled from the previously approved Mine Reclamation Plan ACT/015/032. Soil studies were conducted in accordance with guidelines issued by the Utah Division of Oil, Gas, and Mining. All surveys fulfilled the requirements established by the Soil Conservation Service (SCS).

The coal lease and permit area are delineated on Plate 1-1. The disturbed area is adequately presented on Plate 5-3, which can be cross referenced to Plate 7-1, permitting the viewer to make a technical assessment of the drainage patterns through the permit area and disturbed area.

The applicant will present, in this chapter, a description of the premining soil resources, feasible use of substitute soils, topsoil and subsoil to be saved, stockpiling of soils, and surveys of such soils.

The topsoil piles were inventoried to attempt to determine the disposition of distribution of topsoil and subsoil. All three storage area appeared to be made up of similar material with no distinct change in color and/of texture which might distinguish subsoil or topsoil placement. The inventory consisted of minor probing and ocular estimates of the surface only. It was felt that due to the well established vegetation and the stability of the piles of soil, that a more extensive inventory would serve no purpose other than damage the integrity of the storage sites.

The pedogenic process will become restricted for the soils stored in the topsoil stockpiles. The physio chemical changes that may occur include nitrogen loss, loss of micro biological life forms, the existence of anaerobic conditions within the stockpile areas and structural breakdown of the soils. These changes will be minimized by avoiding compaction during stockpile construction and by segregating the individual soil units.

#### 2.20 Environmental Description:

The area of disturbance is found at an elevation of approximately 7500-7800 feet on a southern exposure with slopes ranging from 5% to 70%. The soils have formed from the weathering sandstone and shale, and are classified as Entisols and Mollisols.

The Entisols are shallow and found on the steeper slopes and have a high erosional hazard. The Mollisols are found on more

modern slopes. They are deep, well drained soils with an A horizon ranging from 8 to 32 inches thick and have an erosion hazard that is moderate to low. The mean annual soil temperature is 40 to 44 degrees F and the average annual precipitation is 20 to 23 inches.

The Entisols are classified as poor for the recoverability of topsoil due to the steepness of slope (50-70 percent) and the high percent of large rocks on and in the surface layer (35-60 percent). Recovery of topsoil from these areas would be difficult. The map unit of these soils is DPH2-Noney Variant-Podo rock outcrop complex, 50-70 percent slopes, eroded. The Mollisols generally have a deep, well formed A horizon. These soils in general can produce large amounts of topsoil and subsoil that can be removed, stockpiled and used as good growth medium for reclamation.

#### **2.21 Prime Farmland Investigation:**

The land within the permit area has not been historically used as cropland, therefore applicant hereby formally requests a negative determination. Applicant has contacted SCS in Salt Lake City and has obtained a letter of negative determination enclosed as Appendix 2-1 from Mr. T. B. Huntchings, State Soil Scientist.

Information from the field survey completed by Valley Engineering was sent to SCS and a letter was received by the applicant indicating a negative determination to the alluvial floor determination. The SCS letter is included with this application as appendix 2-2.

#### **2.22 Soil Survey:**

The soil survey sampling was conducted between approximately 7500 feet to 7900 feet as shown on Plate 2-1 for the actual surface disturbance which includes some areas at elevations greater than 7800 feet. Accurate soil survey information and productivity data was obtained and is representative of the entire disturbed area, as presented in Appendix 2-3 and Plate 2-1.

##### **2.22.2 Soil Identification**

See "Soil Study" report prepared by Valley Engineering included as Appendix 2-3 and the "Soil Types Study Map" included as Plate 2-1.

##### **2.22.3 Soil Description**

See "Soil Study" report prepared by Valley Engineering included as Appendix 2-3 and the "Soils Types Study Map" included as Plate 2-1.

The location and dimensions of existing portals, areas of waste, spoil, etc. from previous mining is shown on Plates 3-7, 3-

8, and 3-9.

#### 2.22.4 Present and Potential Productivity of existing soils

The present and potential productivity of soil within the disturbed area has been assessed to determine the volume of suitable growth materials and the difference between topsoil and subsoil. The following data has been supplied in Appendix 2-3: SAR-sodium absorption ratio; electrical conductivity; saturation percentage; soluble calcium, magnesium and sodium; organic matter content; and lime requirement. Included with Appendix 2-3 is the chemical and physical analysis of the soils within the disturbed area (D).

As described in Appendix 2-3 on page 9, the only significant limitation the soils have for use as topsoil or subsoil is the rock fragments. The electrical conductivity ECE are very low in all samples as shown on page 8. There are no problems with salinity. The SAR are also very low in all samples, indicating there are no problems with sodium salts, the pH is normal for calcareous soils. All samples have some presence of lime.

#### 2.23 Soil Characterization

The soil survey is in accordance with the standards of the National Cooperative Soil Survey and with the procedures set forth in the U.S. Department of Agriculture Handbook 436 (Soil Taxonomy, 1975) and 18 (Soil Survey Manual, 1951).

#### 2.24 Substitute Topsoil

Topsoil and subsoil was removed in a separate layer from all areas subject to surface disturbance except for map unit DPH2. The removal of topsoil from these areas was restricted to the steep slopes of 30% and greater and the high percent of large rocks present in the soil profile. The subsoil from the JDE map unit will be used as a topsoil substitute for reclamation of the steep rocky slopes associated with the DPH2 soils. The acreage of DPH2 soils to be reclaimed is 2.39 acres.

On June 2, 1992, Mr Larry Johnson and personnel from Environmental Industrial Service inventoried three areas that have been contemporaneously reclaimed. The areas in Question are shown on figure 2-1 and are listed as area 1, 2, and 3 respectively. The purpose of the inventory was to determine the depth of in-place soil and the success of the revegetation.

Soil depths were determined utilizing a six foot probe driven into the ground on approximately 5 foot centers. At each test point, the probe was driven in three times in an area approximately 12 inches in diameter at a 90 degree angle to the surface and the

depth of soil noted. The maximum depth encountered was then recorded and plotted. The results of the inventory indicated that none of the reclaimed areas were utilized as topsoil storage sites. A small portion of Area 1 had soil material to a depth of 24 inches, however, it was not felt to have been placed but was rather residual soil that had not been disturbed due to its' close proximity to one of the islands of undisturbed vegetation. In addition to the reclaimed areas, the soil depths of the two undisturbed areas were also inventoried. Both areas average 39 inches of soil, but were in combination with approximately 50% cobble size rock (4 inches to 6 inches in diameter) and as such, would yield less than 18 inches of usable top and subsoil if salvaged. As such, the net gain in material to be utilized in other areas does not appear to justify the destruction of the existing established islands of mature vegetation.

2.30 OPERATION (R645-301-230)

2.31 General Requirements

2.31.1

All topsoil and subsoil was removed during the construction season of 1982. Actual procedures are not known. Based on the data available, the following suppositions are stated:

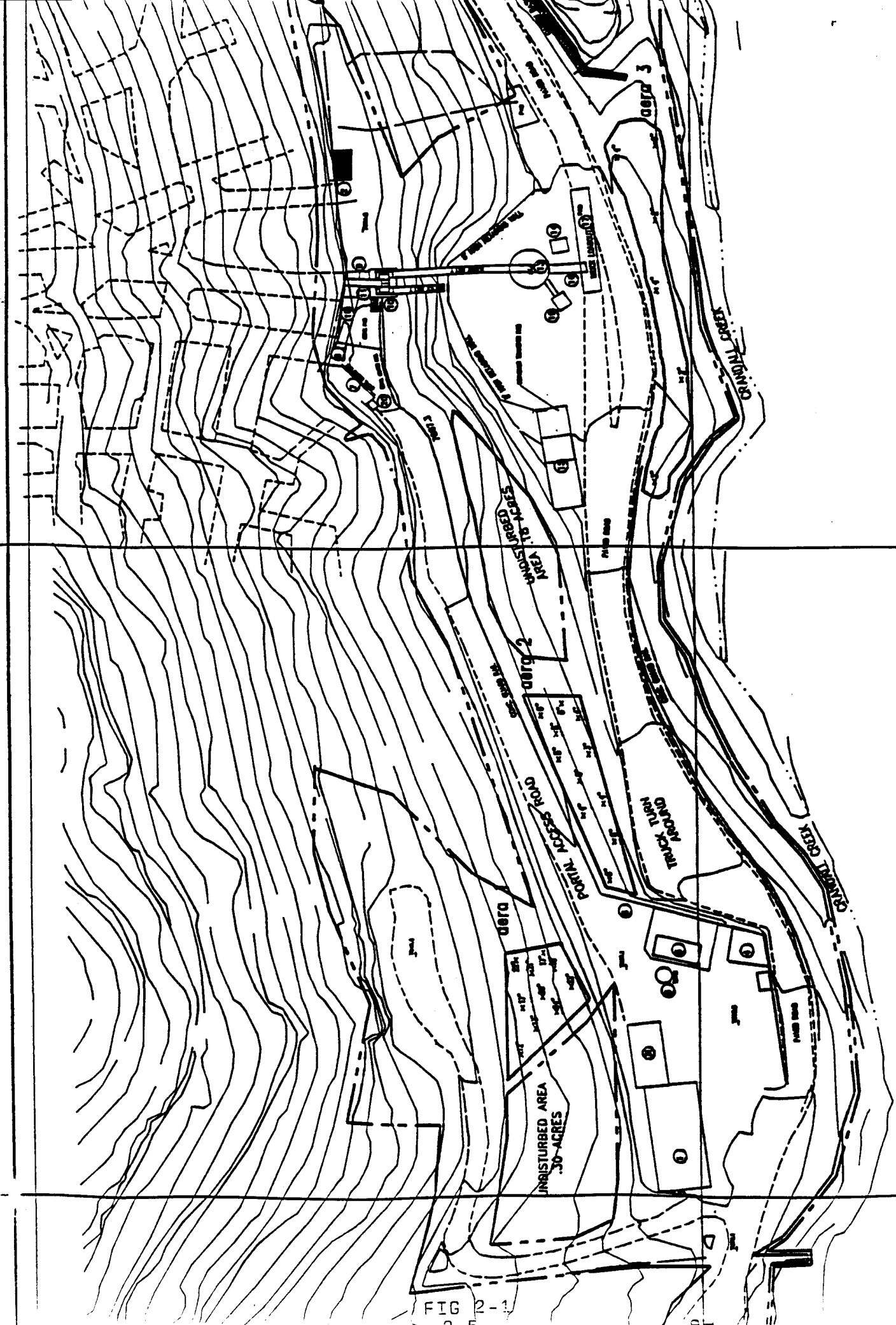


FIG 2-1  
2-5

The subsoil and topsoil was not stockpiled separately. Topsoil and subsoil was removed in one lift with the depth of topsoil determined by soil color monitoring by the operator. The lift depth varied as shown within the "soil Study" report, Appendix 2-1.

Topsoil and subsoil was removed and stored in the permanent stockpile location as shown on Plate 2-2. (The three stockpiles located on Plate 2-2 are within the permit area and the disturbed boundary).

The topsoil was removed from the areas indicated on the soil survey map as TCE and JDE, which includes the Datino Variant, Jodero Variant and Twin Creek soils, after vegetative cover that would interfere with the use of the topsoil was cleared from the areas. A front end loader and a D-6 size dozer was used to remove and load topsoil into haul trucks. A qualified person of supervisory capacity monitored the topsoil removal and stockpiling operation to insure the protection and preservation of all topsoil material. The topsoil stockpile was worked with a small Cat D-6 size track dozer to minimize compaction to the stockpile while dressing the stockpile to final design configuration.

The topsoil stockpiles are adjacent to the public access road as requested by the USFS.

The annual and perennial plants that were used to stabilize the topsoil stockpiles for interim reclamation is the seed mixture described in Chapter 3.

#### 2.31.2

The soil survey and chemical analysis for the proposed topsoil substitute has been completed. A portion of the B. horizon of the TCE soil was salvaged and stockpiled along with that from the JDE to insure that an adequate supply of plant growth medium will be available for reclamation of the steep slopes of 50 to 70 percent. Should erosion occur on the steep slopes, a stabilization method such as a mulch will be incorporated as a preventative.

#### 2.31.3

Testing plans for evaluating the results of topsoil handling is discussed within section 2.42 of this chapter. Sampling technics are discussed in section 2.41. Nutrients and soil amendments will be added based on these tests.

#### 2.31.4

The volume of each stockpile is included on Plate 2-2 as well as in Sections 2.22 and 2.42 of this application. See Appendix 2-4 Justification and Rational for 6" topsoil redistribution.

The soil is protected from erosion, compaction, and contamination. An earthen berm and asphalt berm in combination with straw sediment control has been constructed to protect against topsoil loss and has been revegetated with an approved vegetative cover.

The cross sectional views of the topsoil and subsoil stockpiles are included on Plate 2-3. Applicant has submitted Plate 2-2 showing the location of the topsoil stockpiles with respect to the surface facilities.

Topsoil markers are installed. Perimeter and topsoil markers conform to DOGM regulations

#### **2.32 TOPSOIL AND SUBSOIL REMOVAL**

All topsoil and subsoil was removed during the construction season of 1982. The volumes of salvaged topsoil and subsoil are included in Section 2.42 of this chapter. The topsoil was stored in three locations as shown on Plate 2-2 for the area to be disturbed and in two separate locations from previous stripping as shown on Plate 2-2.

#### **2.33 TOPSOIL SUBSTITUTE AND SUPPLEMENTS**

Section 2.24 and 2.42 of this chapter addresses the substitute topsoil soils and their perspective locations.

#### **2.34 TOPSOIL STORAGE**

All topsoil and subsoil was removed during the construction season of 1982. The volumes of salvaged topsoil and subsoil are included in Section 2.41 of this chapter. The topsoil was stored in three locations as shown on Plate 2-2 for the area to be disturbed and in two separate locations from previous stripping as shown on Plate 2-2.

Sections 2.31 and 2.42 of this chapter addresses the topsoil storage and location of the topsoil piles.

#### **2.40 RECLAMATION PLAN**

#### **2.41 GENERAL REQUIREMENTS**

The permit application includes plans for redistribution of soils, use of soil nutrients and amendments and stabilization of soils.

#### **2.42 SOIL REDISTRIBUTION**

A mass balance is presented below for the 6.09 acre surface

facility site and 0.90 acre topsoil stockpile areas. 0.48 acres within the surface facility site area will not be disturbed during mining operations and will not require soil redistribution. Based on a preliminary survey, The 0.90 acres comprising the three topsoil/subsoil locations will not require soil redistribution since its' native topsoil is still in place. The USFS access road will be left intact removing an additional 1.2 acres from reclamation requirements. The remaining 4.51 acres will have soil redistributed in a uniform 0.50 foot layer, requiring a topsoil volume (or suitable substitute) of 3,688 cubic yards. The topsoil requirements were met from the following area:

SOIL	ACREAGE	YARDAGE	DEPTH
JDE Topsoil	1.46	UK	UK
JDE Subsoil	1.46	UK	UK
Stockpile 1 (JDE & TCE)	0.20	943	NA
Stockpile 2 (JDE & TCE)	0.20	1087	NA
Stockpile 3 (JDE & TCE)	0.50	1671	NA
TOTAL		3701	

The subsoil material has been chemically and physically analyzed, allowing for the determination of the suitability as a plant growing media as presented in Appendix 2-3. The subsoil was removed from the JDE and TCE areas as shown on Plate 2-1 and the surface plan Plate 5-3.

Topsoil and subsoil of the JDE soil type are stored at the above referenced 3 locations, refer to Plate 2-2. Topsoil stockpiles are a mixture of soil types JDE and TCE. The soil types were not segregated during placement in the existing topsoil stockpiles. Topsoil piles will be maintained in their present location and condition until approval is received from the regulatory agency for distribution.

Topsoil will be redistributed with a small front end loader on cat tracks and a D-6 size dozer. A qualified person of supervisory capacity will monitor on site the topsoil redistribution operation. This monitoring will ensure even distribution of the soil. To minimize compaction of the topsoil, after redistribution, the topsoil will be disced and/or harrowed on the contour. The disturbed areas will be ripped prior to topsoil redistribution. Any reclaimed areas that exhibit rills and gullies in excess of six inches will be regraded and seeded.

If possible, the topsoil will be redistributed in the late fall (late September or early October) just prior to the seeding

time so as to have a seedbed free of weeds and annual grasses. If the seedbed is prepared early and weeds and annual grasses become established on it before seeding, they will be removed before seeding is attempted. Seeding will be done as soon as possible after the seedbed is prepared, but not prior to October 1st. If this can not be done within 30 days, the Division will be notified.

Topsoil will have to be removed from disturbed surface area prior to grading and leveling. There will be a loss of soil vegetation that it will support and creation of source of dust emission.

The DPH2 topsoil was not salvaged due to steepness of slope and the poor recovery if stockpiling would be attempted.

No borrow areas will be required to assure an adequate volume of topsoil or adequate substitute for redistribution. Due to the limited space within the disturbed area, the subsoil, which will serve as a topsoil substitute, will be stored directly adjacent to the topsoil stockpile as labeled on Plate 2-2. Attempts will be made to avoid any top and subsoil mixing during placement in the stockpile.

No terracing will be done. All final grading, preparation of overburden before replacement of topsoil will be done along the contour to minimize erosion and instability unless this operation becomes hazardous to equipment operators in which case the grading, preparation, and placement in a direction other than generally parallel to the contour will be used. See chapter 5, section 5.40 for further information.

The applicant has determined the coal to have an acid forming potential, however all the salable coal will be removed from the site prior to redistribution. The chemical analysis of the coal and overburden may be found in Appendix 6-2. The applicant has provided the results of chemical analysis for overburden on pages 8 and 10 with Appendix 2-3.

All coal will be removed from the site as salable product prior to reclamation. The toxicity of the material below the coal stockpile will be tested prior to soil redistribution and treated as necessary. No underground waste is anticipated for storage on the surface which would require that a plan be submitted for treating and acid and/or materials.

Postmining topographic views of the area disturbed by surface facilities are shown on Plate 5-16 and 5-17. The contour map shows the final surface configuration of the permit area which can be used in conjunction with the premining surface configuration map.

## RECONTOURING

All areas affected by surface operations will be graded and restored to a contour that is compatible with natural surroundings and post mining land use. See map included with Vegetation and Terrestrial Wildlife Report included as Appendix 3-3 in chapter 3. For approximate contours prior to our surface disturbance refer to the maps presented as Plates 3-7, 3-8, and 3-9.

## REMOVAL OR REDUCTION OF HIGHWALL

See Chapter 5, Engineering, section 5.40, Reclamation plan

### 2.43 SOIL NUTRIENTS AND AMENDMENTS

Applicant has committed to adding nutrients as recommended by lab analysis conducted on topsoil samples after redistribution for final reclamation. The method used to ensure adequate and representative samples from different locations and depths within the topsoil stockpile used for lab analysis is presented below. Amendments to soil as per "Soil Survey" recommendations (See Appendix 2-3)

The topsoil samples will be analyzed, and will include six auger samples; two from the top 1/3, two from the middle 1/3, and two from the lower 1/3. All lab work will be conducted by a qualified laboratory using methods approved by the Division.

Each auger sample will be taken on the correct angle to the approximate center of the pile. The angle and center of the pile are to be determined from an engineering sketch, drawn prior to the sampling. Each sample will then be mixed and quartered to the size necessary for lab determination of necessary amendments. Results of the six samples, along with consultation from the regulatory authority, will determine the necessary amendments to the topsoil.

Nutrients and soil amendments, if shown to be required by a soil test shall be applied to the redistributed topsoil layer by broadcast methods and tilled into the top 6 inches so that it supports the required vegetation. Topsoil stockpiles will be amended after redistribution to assure even distribution of fertility amendments. The topsoil will be redistributed in the late fall (late September or early October) just prior to the seeding time so as to have a seedbed free of weeds and annual grasses. If the seedbed is prepared early and weeds and annual grasses become established on it before seeding, they will be removed before seeding is attempted. A clean seedbed is essential at the time of seeding. Due to the possibility of surface water degradation of fertilizer, nutrients and soil amendments, they will both be applied after October 1.

One ton of alfalfa will be incorporated into the redistributed topsoil and substitute topsoil for increased fertility and physical structure enhancement.

Soil test data along with recommended amendments in the case of soil deficiencies will be submitted to the all concerned regulatory agencies prior to soil redistribution.

No mitigation plans are proposed for the soil resources except for the addition of nutrients to the topsoil and subsoil after redistribution during the reclamation process.

Any nutrient loss to the soils will more than be rectified by amendments.

#### **2.44 SOIL STABILIZATION**

Before the topsoil is redistributed, the area of disturbance will be regraded and treated as required by the Division to lessen the chance of slippage and promote root growth. Before topsoil replacement, the subsoil will be disced in areas having average slopes of less than 30% and ripped in other areas until the grade becomes impractical. On slopes of 30% and less a wood fiber mulch of 1.5 tons per acre will be used which will be anchored into the soil with a tackifying agent that will bind it together. The steeper slopes will require a hydro-mulch of one ton of wood fiber in combination with tack which will be suspended in water to form a slurry type material and shall be sprayed evenly over the area. Topsoil will be redistributed in a manner that achieves an approximate, uniform stable thickness on the land that will prevent excess compaction of the topsoil. The topsoil will be protected from wind and water erosion before and after it is reseeded and planted by contour grading and the application of mulch. The topsoil will be redistributed with a front end loader and D-6 size dozer. To minimize compaction of the topsoil, after redistribution, the topsoil will be disced and/or harrowed on the contour.

#### **2.50 PERFORMANCE STANDARDS**

All topsoil, subsoil and topsoil substitutes or supplements will be removed, maintained and redistributed according to the plan given under R645-301-230 and R645-301-240.

#### **2.52**

All stockpiled topsoil, subsoil and topsoil substitutes or supplements will be located, maintained and redistributed according to plans given under R645-301-230 and R645-301-240.

Stockpiled topsoil will be protected through a combination of berms vegetative cover and silt barriers such as silt fences and/or straw filters. In addition those piles adjacent to the main access road that could be adversely impacted by salt used in ice removal will be closely monitored to determine if the vegetation is adversely impacted. In the event damage is in evidence, salt use will be suspended in those areas adjacent to topsoil piles.

5/3/93

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